

IntelliDrive(SM)¹ Mobility and Environment Workshop (2010) Stakeholder Feedback Summary

Meenakshy Vasudevan, Noblis

The IntelliDrive Mobility and Environment Workshop was held in Arlington, VA on November 30 and December 1, 2010 under the sponsorship of the USDOT IntelliDrive Program. The goals of the workshop were to:

- *inform* stakeholders on foundational concepts, organization, schedule, projects, procurements and products of the Mobility Research Program (Real Time Data Capture and Management and Dynamic Mobility Applications)
- *confirm* stakeholder concurrence on program direction
- *motivate* stakeholder utilization of program products, participation in upcoming procurements
- *capture* stakeholder feedback on targeted cross-cutting issues regarding data sharing and open source application development

Workshop participants (152 registered attendees) included representation from public and private sectors, as well as academia (Figure 1).

One aspect of the workshop included systematic stakeholder feedback on the results of a recent call for submission of ideas of transformative IntelliDrive-enabled mobility applications. These applications envision the use of IntelliDrive data and communications technologies to improve the nature, accuracy, precision or speed of dynamic decision making by system managers and users to improve mobility. The call generated 93 ideas, of which a total of 23 ideas were out of scope for the Dynamic Mobility Applications Program. Concepts out of scope for the Dynamic Mobility Applications Program were referred to other program areas such as Real-Time Data Capture and Management, Safety, and AERIS. The remaining concepts were consolidated into 33 concepts since many submissions were similar in nature or variants of a single concept. At the workshop, participants were asked to identify promising applications from the collection of 33 concepts considering synergies between applications; balancing near-term risks and long-term impacts; and effectively leveraging IntelliDrive data. To this end, two breakout exercises were held, one on each day. Note that only non-federal stakeholders participated in the voting exercises.

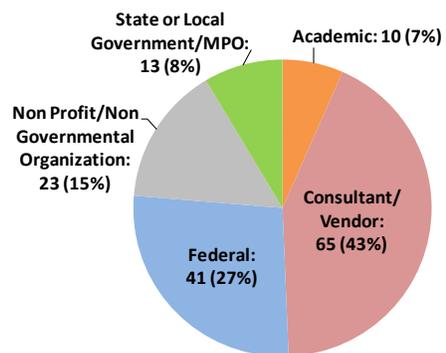


FIGURE 1. STAKEHOLDER REPRESENTATION

Day 1 Breakout Exercises: Applications and Data Environments

On Day 1, the breakout exercise was organized around data environments: Arterial, Freeway, Corridor, and Regional. In each breakout session, stakeholders were asked to rate (High, Medium, Low) each application concept's potential impact, deployment readiness (i.e., likelihood that the application could be developed, tested, and widely deployed by 2025), and alignment with the Program objectives (including, clear federal role). Participants were also asked to record text

¹ IntelliDrive is a registered service mark of the U.S. Department of Transportation.

commentary along with these ratings to provide insight into their personal rationale for these ratings. Finally, considering the three criteria, each breakout exercise participant voted for the top three most promising applications. Voting followed a 3-2-1 format, with each participant’s top application receiving 3 points, the second application receiving 2 points, and the third application receiving 1 point. It should be noted that only a limited number of application concepts (8 to 12) were included in each breakout session due to time constraints. For example, cooperative adaptive cruise control was not included for discussion in the corridor and regional breakout sessions.

Arterial Breakout Session

Breakout participants ranked IntelliDrive-driven traffic signal system the highest, and voted it as having the highest potential for transformative impact, and the greatest alignment with the goals of the program. Applications that made use of advanced signal control concepts in conjunction with vehicle-to-vehicle control were voted as having the least likelihood of being ready for deployment by 2025. For example, adaptive speed control for efficient traversal of intersections was deemed to have a high risk for deployment by 2025 because of complex safety interactions with pedestrians and bicycles, as well as an expectation that 100% market penetration would be required. Some participants were concerned about identifying a clear federal role in the development of curbside parking availability and general road user traffic signal priority. Table 1 summarizes the results of the voting exercise. The score shown under “prioritization criteria” is an average of the ratings (High=3, Medium = 2, Low = 1) provided by 22 non-federal stakeholders. For example, transit signal priority had a total of 15 votes, with a score of 2.0 out of 3 points for potential for transformative impact, a score of 2.2 for deployment readiness, and 2.0 for alignment with program goals.

TABLE 1. RESULTS: ARTERIAL DATA ENVIRONMENT

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PRIORITIZATION CRITERIA		
				POTENTIAL IMPACT	DEPLOYMENT READINESS	PROGRAM ALIGNMENT
1	I-SIG	IntelliDrive-driven traffic signal system	44	2.8	2.0	2.6
2	TSP	Transit signal priority	15	2.0	2.2	2.0
3	PED-SIG	Mobile accessible pedestrian signal system	15	1.8	2.2	2.2
4	PREEMPT	Emergency vehicle preemption with proximity warning	14	2.1	2.6	2.3
5	ECO	Connected eco driving	13	2.1	2.4	2.1
6	CACC	Cooperative adaptive cruise control	11	2.1	1.3	2.1
7	SIG-FLOW	Adaptive speed control for efficient traversal of intersections	8	2.0	1.2	2.0
8	CURB-PKG	Curbside parking availability	7	1.5	2.4	1.5
9	WX-INFO	Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes	4	1.7	2.0	1.8
10	FSP	Freight signal priority	1	1.6	2.7	1.9
11	GSP	General road user traffic signal priority	0	1.3	1.4	1.1

Freeway Breakout Session

Dynamic speed harmonization was ranked the highest by the 14 non-federal participants at the freeway breakout session. Table 2 summarizes the results of the voting exercise. It should be noted that although cooperative adaptive cruise control was voted as having the potential for higher impact and greater program alignment than incident scene work zone alerts, it got fewer votes (11) than the work zone alerts concept (14). This may have been due to a perceived deployment risk for the 2025 time frame. In fact, cooperative adaptive cruise control had the lowest score for

deployment readiness (1.6), which was analogous to the assessment of participants in the arterial breakout session. Freeway breakout exercise participants were concerned about identifying a clear federal role in the development of applications for electronic toll collection systems, multi-modal real-time traveler information and MDSS communications. However, participants did make the observation that the federal role in the development of the multi-modal traveler information was in the facilitation of provision of multi-modal data or in the development of standards.

TABLE 2. RESULTS: FREEWAY DATA ENVIRONMENT

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PRIORITIZATION CRITERIA		
				POTENTIAL IMPACT	DEPLOYMENT READINESS	PROGRAM ALIGNMENT
1	SPD-HARM	Dynamic speed harmonization	20	2.5	2.5	2.7
2	INC-ZONE	Incident scene workzone alerts for drivers and workers	14	2.0	2.2	2.2
3	CACC	Cooperative adaptive cruise control	11	2.6	1.6	2.6
4	Q-WARN	Queue warning	10	2.4	2.4	2.4
5	ETC	Electronic Toll Collection System	8	1.7	2.4	1.5
6	RAMP	IntelliDrive-driven ramp metering system	5	1.9	2.1	2.1
7	ATIS	Multi-modal real-time traveler information	3	2.0	3.0	1.5
8	WX-MDSS	Enhanced MDSS communications	1	1.3	1.8	1.5

Corridor Breakout Session

Multi-modal real-time traveler information was voted the most promising application concept, with the highest potential for transformative impact, the greatest likelihood for being ready for deployment, and the greatest alignment with the program goals. This was inconsistent with the observations made by participants in the freeway breakout session, who noted a lack of clear federal role in the development of a traveler information application. Table 3 summarizes the results of the feedback received from the 25 non-federal participants in the corridor breakout session. Stakeholders observed that IntelliDrive-driven integrated corridor management was not a change in paradigm; instead IntelliDrive would be the basis for better data. One stakeholder highlighted the need for standards for interoperability.

TABLE 3. RESULTS: CORRIDOR DATA ENVIRONMENT

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PRIORITIZATION CRITERIA		
				POTENTIAL IMPACT	DEPLOYMENT READINESS	PROGRAM ALIGNMENT
1	ATIS	Multi-modal real-time traveler information	54	2.8	2.5	2.8
2	ICM	IntelliDrive-driven integrated corridor management	29	2.7	2.3	2.7
3	F-ATIS	Freight real-time traveler information with performance monitoring	17	2.4	2.4	2.3
4	S-PARK	Smart park and ride	15	1.8	2.4	2.0
5	WX-INFO	Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes	11	2.2	2.0	2.1
6	ETC	Electronic Toll Collection System	7	1.9	2.4	2.0
7	RAMP	IntelliDrive-driven ramp metering system	7	2.0	2.0	2.2
8	DRG	Dynamic routing of vehicles	6	2.3	2.3	2.3
9	F-DRG	Freight dynamic route guidance	4	2.0	2.2	2.1
10	T-Connect	Connection protection	3	1.6	2.0	1.8
11	D-RIDE	Dynamic ridesharing	2	1.5	2.0	1.7
12	RESP-STG	Incident scene pre-arrival staging guidance for emergency responders	1	1.7	1.9	1.9

Regional Breakout Session

Table 4 summarizes the results of the feedback received from the 15 non-federal participants in the regional breakout session. Consistent with results from the corridor breakout session, multi-modal real-time traveler information emerged as the most promising application. However, one participant noted that there was no clear federal role and another observed that traveler response to information was overrated and very few travelers would pay for information. The emergency communications and evacuation application garnered zero votes.

TABLE 4. RESULTS: REGIONAL DATA ENVIRONMENT

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PRIORITIZATION CRITERIA		
				POTENTIAL IMPACT	DEPLOYMENT READINESS	PROGRAM ALIGNMENT
1	ATIS	Multi-modal real-time traveler information	28	2.6	2.7	2.3
2	WX-INFO	Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes	19	2.7	2.2	2.7
3	WX-MDSS	Enhanced MDSS communications	15	2.5	2.3	2.6
4	MAYDAY	Mayday relay	9	2.1	2.2	1.9
5	F-ATIS	Freight real-time traveler information with performance monitoring	8	1.9	2.0	2.1
6	DR-OPT	Drayage optimization	7	1.7	2.0	1.8
7	EFP	Multimodal integrated payment system	6	2.0	2.3	1.7
8	T-MAP	Universal map application	6	1.6	1.5	1.5
9	T-DISP	Dynamic transit operations	2	1.9	1.9	2.1
10	VMT	IntelliDrive-driven mileage based user fees	2	2.3	1.4	2.2
11	T-EVAC	Emergency communications and evacuation	0	2.3	1.7	1.9

Day 2 Breakout Exercises: Applications and Primary Impacts

On Day 2, the breakout exercises were organized around primary impact: Environmental, Productivity, Mobility, and Safety/Security. In each breakout session, stakeholders were asked to collectively identify up to three measures and transformative targets for each measure. Stakeholders then individually rated (High, Medium, Low) each application concept’s potential to achieve the jointly identified transformative targets, and voted for the top three promising applications. Finally, stakeholders collectively refined data and communications needs, and identified research needs for the most promising application(s). As mentioned previously, due to time constraints only a limited number of application concepts were included in each breakout session.

Environmental Breakout Session

The three environmental measures identified by the stakeholders included:

- Tons of Total Emissions (including greenhouse gas and criteria pollutants)
- Total Gallons of Fuel Equivalents
- Mode Split (defined by stakeholders as percentages of non-SOV trips)

Table 5 shows the results from the voting exercise. The score shown for each performance measure is an average of the ratings (High=3, Medium = 2, Low = 1) provided by the 16 non-federal participants in the breakout session. For example, IntelliDrive-driven integrated corridor management had a score of 2.1 out of 3 points for its potential to achieve the target for emissions

reduction, a score of 2.0 to reduce fuel consumption, and a score of 2.1 to increase mode split. IntelliDrive-driven integrated corridor management was ranked the highest with a total of 20 votes. IntelliDrive-driven mileage-based user fee had one fewer vote (19), but was rated higher for its potential to achieve the transformational target for all three measures. Participants observed that environmental impacts would have been more significant for parking applications which were not included in the environmental breakout session.

Data and communications needs were refined for the IntelliDrive-driven integrated corridor management concept. It was observed that for transformative impacts, full market penetration of IntelliDrive-enabled vehicles and deployment of component applications (e.g., IntelliDrive-driven traffic signal system, ramp metering) would be required. Participants also identified the need for standardizing data to enable sharing of data between jurisdictions. Research needs identified include approaches for: quantifying benefits for different deployment levels; incentivizing travel choices; and assigning costs.

TABLE 5. RESULTS: ENVIRONMENTAL IMPACTS

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PERFORMANCE MEASURES		
				EMISSIONS	FUEL CONSUMPTION	MODE SPLIT
1	ICM	IntelliDrive-driven integrated corridor management	20	2.1	2.0	2.1
2	VMT	IntelliDrive-driven mileage based user fees	19	2.6	2.7	2.6
3	I-SIG	IntelliDrive-driven traffic signal system	14	2.6	2.5	1.3
4	ECO	Connected eco driving	9	2.3	2.1	1.1
5	D-RIDE	Dynamic ridesharing	9	2.1	2.2	2.4
6	T-DISP	Dynamic transit operations	7	1.6	1.6	2.3
7	SIG-FLOW	Adaptive speed control for efficient traversal of intersections	4	2.2	2.1	1.0
8	SPD-HARM	Dynamic speed harmonization	1	2.0	1.9	1.1
9	RAMP	IntelliDrive-driven ramp metering system	1	1.8	1.8	1.1

Productivity Breakout Session

The three productivity measures identified by the participants include:

- Ratio of loaded moves to total moves
- Travel time reliability
- Freight tons or passengers per mile per day

A total of 11 non-federal participants voted on the applications (Table 6). Given that all three productivity measures were freight-related, it is not surprising that the top two applications were freight-specific, with freight dynamic route guidance having earned the most number of votes (16). Electronic toll collection and universal map application both had zero votes. Interoperability was the key concern for electronic toll collection. Although other freight concepts were ranked high, freight signal priority was ranked 7th. This may be attributed to the need for community support for deployment of freight signal priority, which was identified as a key issue by one of the participants.

Data and communications needs were identified for freight dynamic route guidance. Participants noted that the application did not require DSRC. Key research needs identified include: modeling freight movement; routing algorithms; and modeling driver distraction. Participants observed that transformative benefits could be realized provided the private sector was able to commercialize the application.

TABLE 6. RESULTS: PRODUCTIVITY IMPACTS

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PERFORMANCE MEASURES		
				LOADED MOVES/ TOTAL MOVES	RELIABILITY	FREIGHT TONS OR PASSENGER MILES/DAY
1	F-DRG	Freight dynamic route guidance	16	2.0	2.7	2.5
2	F-ATIS	Freight real-time traveler information with performance monitoring	13	2.2	2.7	2.4
3	SPD-HARM	Dynamic speed harmonization	10	1.8	2.6	2.4
4	DR-OPT	Drayage optimization	8	2.6	2.2	2.3
5	S-PARK	Smart park and ride	5	1.2	1.9	1.7
6	CACC	Cooperative adaptive cruise control	4	1.4	2.5	2.4
7	FSP	Freight signal priority	4	1.7	2.1	2.3
8	ETC	Electronic Toll Collection System	0	1.2	1.7	1.6
9	T-MAP	Universal map application	0	1.3	1.6	1.4

Mobility Breakout Session

The three mobility measures identified by the participants include:

- Travel time reliability at a known cost
- Accessibility/livability
- Portability/availability/extensibility (defined by participants as the percent of geography/population with access to the application)

Table 7 summarizes the feedback from 29 non-federal participants. Multi-modal real-time traveler information was ranked the highest. ATIS was also voted as having the highest overall potential to achieve transformative targets for increased reliability, accessibility and availability. It was noted that knowledge of traveler choices would make traveler information more effective, and this would require two-way communication between the traveler and the system.

TABLE 7. RESULTS: MOBILITY IMPACTS

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PERFORMANCE MEASURES		
				RELIABILITY	ACCESSIBILITY	AVAILABILITY
1	ATIS	Multi-modal real-time traveler information	62	2.8	2.7	2.8
2	ICM	IntelliDrive-driven integrated corridor management	35	2.9	2.4	2.1
3	TSP	Transit signal priority	21	2.6	2.4	2.2
4	DRG	Dynamic routing of vehicles	14	2.4	2.1	2.5
5	T-CONNECT	Connection protection	14	2.4	2.3	2.0
6	EFP	Multimodal integrated payment system	12	2.1	2.6	2.4
7	WX-INFO	Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes	8	2.2	1.9	2.1
8	D-RIDE	Dynamic ridesharing	5	1.9	2.3	2.1
9	CURB-PKG	Curbside parking availability	3	1.8	2.1	1.8
10	GSP	General road user traffic signal priority	0	1.5	1.3	1.3

Safety/Security Breakout Session

The three safety/security measures identified by the participants include:

- Fatalities
- Delays due to incidents
- Secondary crashes

Table 8 summarizes the voting results from 13 non-federal participants. Queue warning was ranked the highest. It was noted that 50% of rear-end crashes in Japan occurred at intersections. Interestingly enough, emergency vehicle preemption was ranked low with only two votes. This may have been due to participants’ perception that the concept was not innovative or transformative. As noted in the arterial breakout session, cooperative adaptive cruise control was again identified as being too advanced or futuristic for a 2025 deployment time frame.

Participants refined the top four application concepts. Queue warning and incident scene work zone alerts for drivers and workers were identified as having synergies with requirements for safety applications and dynamic speed harmonization.

TABLE 8. RESULTS: SAFETY AND SECURITY IMPACTS

RANK	APPLICATION CODE	NAME OF APPLICATION	TOTAL VOTES	PERFORMANCE MEASURES		
				FATALITIES	DELAYS DUE TO INCIDENTS	SECONDARY CRASHES
1	Q-WARN	Queue warning	28	2.5	2.2	2.7
2	INC-ZONE	Incident scene workzone alerts for drivers and workers	17	2.5	2.2	2.2
3	PED-SIG	Mobile accessible pedestrian signal system	11	2.2	1.6	1.4
4	WX-MDSS	Enhanced MDSS communications	10	1.5	1.8	1.8
5	RESP-STG	Incident scene pre-arrival staging guidance for emergency responders	8	2.0	2.2	1.7
6	CACC	Cooperative adaptive cruise control	4	1.5	1.6	1.8
7	PREEMPT	Emergency vehicle preemption with proximity warning	2	1.8	1.8	1.6
8	MAYDAY	Mayday relay	2	1.8	1.4	1.0
9	T-EVAC	Emergency communications and evacuation	2	1.6	1.9	1.1

Conclusions

The application concepts that made it to the top ten among all breakout sessions were representative of all modes, including highways, transit (TSP), freight (F-ATIS, F-DRG), pedestrians (PED-SIG), emergency vehicles (INC-ZONE), implying representation at the workshop from a cross-section of agencies and expertise. Table 9 shows the average scores received for the 33 application concepts among all breakout sessions. An application received 6 points for any session where it was ranked #1, 5 points when ranked #2, 4 points when ranked #3, 3 points when ranked #4, 2 points when ranked #5, and 1 point when ranked #6. For example, IntelliDrive-driven traffic signal system (I-SIG) appeared in two (2) out of the eight (8) breakout sessions. The maximum I-SIG could have accrued is 12 points. It was ranked #1 in one session and #3 in the other session, resulting in a weighted score of 83% (10 points/12 points). Overall, IntelliDrive-driven integrated corridor management (ICM) was ranked highest among all breakout sessions. It appeared in three (3) of the eight (8) breakout sessions, and was ranked #1 in one session and #2 in the remaining two sessions, resulting in a total score of 89%. It should be noted that although ICM was ranked the highest, as noted in the environmental breakout session, transformative benefits can be realized only if component applications are in place.

Feedback collected at the public meeting will serve to inform the federal team but will not determine application priority. For briefing materials used at the public meeting, including breakout session reports, please visit: <http://www.its.dot.gov/meetings.htm>.

DRAFT

TABLE 9 MOST PROMISING APPLICATIONS ACROSS ALL BREAKOUT EXERCISES

RANK	APPLICATION CODE	NAME OF APPLICATION	# OF OCCURRENCES IN BREAKOUTS	PRIORITY						TOTAL WEIGHTED SCORE
				#1	#2	#3	#4	#5	#6	
1	ICM	IntelliDrive-driven integrated corridor management	3	1	2	0	0	0	0	89%
2	INC-ZONE	Incident scene workzone alerts for drivers and workers	2	0	2	0	0	0	0	83%
3	I-SIG	IntelliDrive-driven traffic signal system	2	1	0	1	0	0	0	83%
4	ATIS	Multi-modal real-time traveler information	4	3	0	0	0	0	0	75%
5	TSP	Transit signal priority	2	0	1	1	0	0	0	75%
6	Q-WARN	Queue warning	2	1	0	0	1	0	0	75%
7	PED-SIG	Mobile accessible pedestrian signal system	2	0	0	2	0	0	0	67%
8	F-ATIS	Freight real-time traveler information with performance monitoring	3	0	1	1	0	1	0	61%
9	SPD-HARM	Dynamic speed harmonization	3	1	0	1	0	0	0	56%
10	F-DRG	Freight dynamic route guidance	2	1	0	0	0	0	0	50%
11	S-PARK	Smart park and ride	2	0	0	0	1	1	0	42%
12	ECO	Connected eco driving	2	0	0	0	1	1	0	42%
13	VMT	IntelliDrive-driven mileage based user fees	2	0	1	0	0	0	0	42%
14	WX-MDSS	Enhanced MDSS communications	3	0	0	1	1	0	0	39%
15	DR-OPT	Drayage optimization	2	0	0	0	1	0	1	33%
16	WX-INFO	Real-Time Route Specific Weather Information for Motorized and Non-Motorized Modes	4	0	1	0	0	1	0	29%
17	PREEMPT	Emergency vehicle preemption with proximity warning	2	0	0	0	1	0	0	25%
18	CACC	Cooperative adaptive cruise control	4	0	0	1	0	0	2	25%
19	T-CONNECT	Connection protection	2	0	0	0	1	0	0	25%
20	MAYDAY	Mayday relay	2	0	0	0	1	0	0	25%
21	RESP-STG	Incident scene pre-arrival staging guidance for emergency responders	2	0	0	0	0	1	0	17%
22	DRG	Dynamic routing of vehicles	2	0	0	0	0	1	0	17%
23	ETC	Electronic Toll Collection System	3	0	0	0	0	1	1	17%
24	RAMP	IntelliDrive-driven ramp metering system	3	0	0	0	0	0	2	11%
25	D-RIDE	Dynamic ridesharing	3	0	0	0	0	1	0	11%
26	EFP	Multimodal integrated payment system	2	0	0	0	0	0	1	8%
27	T-DISP	Dynamic transit operations	2	0	0	0	0	0	1	8%
28	FSP	Freight signal priority	2	0	0	0	0	0	0	0%
29	T-MAP	Universal map application	2	0	0	0	0	0	0	0%
30	T-EVAC	Emergency communications and evacuation	2	0	0	0	0	0	0	0%
31	CURB-PKG	Curbside parking availability	2	0	0	0	0	0	0	0%
32	GSP	General road user traffic signal priority	2	0	0	0	0	0	0	0%
33	SIG-FLOW	Adaptive speed control for efficient traversal of intersections	2	0	0	0	0	0	0	0%